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**Technology and Friction  
in the Schlieffen Plan**

**Core Course 2 Essay**

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**Course 2: Foundations of Military Thought and Strategy**

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"Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced it. Countless minor incidents - the kind you can never really foresee - combine to lower the general level of performance so that one always falls far short of the intended goal."

Carl von Clausewitz<sup>1</sup>

## INTRODUCTION

One of the principal reasons that Germany lost World War I was the failure of the "Schlieffen Plan of 1905,"<sup>2</sup> its strategic scheme to knock France quickly out of the war. The plan involved a wide counter-clockwise sweep by the German right (Northern) flank through Belgium and Luxembourg and around Paris in order to outflank the French Army which was concentrated in positions further south along the German-French border. The Germans then intended to surround and destroy the French Army in a "kesselschlacht," or "decisive battle of encirclement and annihilation."<sup>3</sup> Success hinged on rapid mobilization as well as operational speed and concentration to resolve the issue quickly and the plan was utterly dependent on the railroads. In August 1914, the plan fell short. As a result, Germany had to fight a two-front war of attrition which eventually led her into submission.

The failure of the Schlieffen Plan can be traced to its neglect of many of Clausewitz's most basic principles. Yet interwoven throughout all of its shortcomings is another fundamental factor that Clausewitz did not discuss in great detail but which contributed to each failure and carries enormous relevance to modern U.S. strategic military thought: excessive reliance on technology.<sup>4</sup>

By "technology" I mean both the specific mechanical devices as well as the systems through which they are integrated into military operations. Thus, "railroads" include not only the trains, tracks and other physical objects associated with transport but also the mobilization schedules, staging plans, and other intangible elements which constituted the control system that enabled it to contribute to the military effort. Understood in this way, technology was related to nearly every instance where the plan neglected key principles of Clausewitz.

Schlieffen's inordinate dependence on technology sprang from a rejection of Clausewitz's concept of "friction." This in turn led to an overly-ambitious, inflexible plan and an imbalanced military-

political relationship<sup>5</sup> This paper explores those Clausewitzian weaknesses of Schlieffen's Plan in light of technology, particularly the railroads and will suggest some lessons which apply today

## BACKGROUND

The origins of the Schlieffen Plan date back almost 50 years before the opening of WWI From its earliest days, Germany's main fear was a two-front war with France and Russia<sup>6</sup>. From the time of Moltke the Elder, chief of the German General Staff from 1857-1887<sup>7</sup>, much of Germany's war planning effort was directed toward preparing for such an eventuality The Schlieffen Plan of 1905 was actually the sixteenth plan Schlieffen had devised against France and the nineteenth he had made for a two-front war<sup>8</sup> Therefore to understand the Schlieffen Plan it is helpful to trace the evolution of the war plans from which it descended

When Schlieffen became chief of the German General Staff in 1891, he inherited plans which had been largely developed by Moltke the Elder Those plans for a two-front war were based on an offensive-defensive strategy which relied on a short, quick military action, followed by a speedy political conclusion on at least one front.<sup>9</sup> Moltke was a self-professed disciple of Clausewitz who believed his mentor's admonition that "of all the possible aims in war, the destruction of the enemy's armed forces always appears as the highest"<sup>10</sup> Nonetheless, he firmly grasped the potential impact of "friction"<sup>11</sup> and "fog"<sup>12</sup> and recognized the difficulty of winning a quick victory on either front<sup>13</sup> Six years after the Franco-Prussian war, Moltke wrote that even after a decisive battle in France early in a future two-front war "It must be left to diplomacy to see if it can achieve a peace settlement on this front"<sup>14</sup> Moltke thus adopted Clausewitz's "other way" to victory<sup>15</sup> seizing military objectives of political value Though he opposed political involvement in the actual conduct of the war Moltke recognized the importance of tailoring the military objectives to the political ones.

## SCHLIEFFEN AND "FRICTION"

In sharp contrast to Moltke the Elder, Schlieffen essentially rejected Clausewitz's concept of "friction"<sup>16</sup> He believed that thorough pre-planning could remove most of the uncertainty from any

operation and "compel the opponent to conform substantially to one's own operational strategy"<sup>17</sup>

To the degree that he recognized friction at all, it was purely technical in nature. Schlieffen regarded friction in terms of efficiency and organization, hence something that could be controlled through detailed pre-planning and centralized control<sup>18</sup>. Over time, the primary goals of speed and concentration were overshadowed by subsidiary issues of timing of mobilization orders, railroad schedules, equipment maintenance, switching coordination, efficient use of the limited rail lines, and other secondary planning factors. Because of this exclusive focus on the internal friction of technical efficiency, he discounted other more critical forms of friction such as surprise by the enemy, misunderstanding, failure of allies, weather, etc. Thus, Schlieffen failed to grasp Clausewitz's wider meaning of the term, resulting in far greater friction on the battlefield where his plan could not meet his expectations.

#### CREATION OF NEW VULNERABILITIES

Technology seldom simplifies war, and nearly always makes it more complicated. Since war is a clash of opposing, reacting wills<sup>19</sup>, reduction of friction in one area tends to create it in others where it hadn't existed before<sup>20</sup>. The introduction of new tactics or technology often creates new strategic vulnerabilities as the enemy reacts to the innovations or unforeseen dependencies emerge. For example, in Schlieffen's plan, railroads which were introduced to move the instruments of war became strategic targets themselves, generating a new set of execution problems, targets, and countermeasures.

This perverse propensity for increased friction to arise from innovations designed to reduce it is further aggravated by the natural tendency of military planners to exploit any new capability to its limit. Development of a system of efficient, high-capacity railroads led to plans involving much larger forces and greater distances than were previously possible. The resulting plans **required** the higher volume made possible by railroads for its success.

Synergy cuts both ways. Technologies or novel tactics which multiply effectiveness when they work can divide it by an even bigger factor when they fail. The expedients for dealing with a system

breakdown may not have been developed because the users had not foreseen every way in which it can fail or be neutralized. Older, less "efficient" alternatives which possibly could have compensated for a failure of the new system may have been discarded, especially if the new technology represents a significant improvement and resources are limited.<sup>21</sup> This may create a critical dependency on a single technology whose limitations and vulnerabilities may not be fully understood until the war arrives. Thus, railroads which made the Schlieffen Plan possible became an enormous liability when disrupted or neutralized, forcing delay and redirection of the strategic effort and inflicting severe hardships on the soldiers. Centralization of control, made possible by the telegraph, became delay, paralysis, and strategic blindness when it was cut, integration of effort was lost, and front line units waited for orders, losing valuable opportunity. Technology greatly increases the speed and danger of war.

CHANGE IN CULMINATING POINT<sup>22</sup>

Another result of Schlieffen's disregard of the friction caused by enemy reaction was his failure to foresee the change in the culminating point of his attack. The same qualities of railroads which increased the number of troops and supplies and the speed at which they could be moved also expanded the size and scope of the battlefield proportionately. Although the Germans could move more faster and further, so could the Allies. The French had learned to make use of the railways themselves and capitalized on their interior lines to keep pace with the German moves, neutralizing much of the strategic advantage Schlieffen had planned to exploit. This rendered his objectives too ambitious, and the German attack expended itself before achieving the complete envelopment called for under the plan. As a rule, friction reduces the effectiveness of any operational plan and retards the culminating point of the proposed effort. While this does not mean failure for every plan, it does mean that few achieve all they intend. In the case of the Schlieffen Plan, however, this reduction in the culminating point was tantamount to complete failure, since the plan was the foundation of an overall German national strategy which depended on a rapid total victory on the Western Front.

## POLITICAL-MILITARY RELATIONSHIPS

Clausewitz's principle of war as instrument of policy<sup>23</sup> defines war's role, but does not preclude military participation in political decisions relating to the military.<sup>24</sup> In fact, Clausewitz urged a role for the military chief in the cabinet to ensure that the military instrument is used in a manner consistent with its capabilities.<sup>25</sup> Moltke the Elder understood this balance. As discussed earlier, he saw that the nation's strength lay in the coordinated activities of both military and political spheres. Accordingly, diplomacy was an integral part of his war plans and worked to offset some of Germany's military resource limitations. His successors did not share his grasp of that principle.

Waldersee, Schlieffen's predecessor, was removed after only two years as Chief of the General Staff for his excessive meddling in politics.<sup>26</sup> Schlieffen displayed the opposite tendency, focusing more on the technical aspects of war planning and neglecting his responsibilities to fold political flexibility into his war plans.<sup>27</sup>

Schlieffen's plans were developed in such isolation from the changing political landscape of the late 19th century, that their technical purity and abstraction became a liability. They rose like ivory towers built on military theory alone, unmixed with the binder of political reality. In Schlieffen, Clausewitz's proper and respectful detachment from political entanglements degenerated into an indifference to the political forces driving the nations toward war. His strategies fixated on the mere mechanics of surrounding and destroying the enemy army. Freed from cumbersome political restrictions, his plans became increasingly complex, ambitious, and rigid, progressively excluding allowance for any sort of friction.<sup>28</sup> In an effort to achieve the efficiency required to fully exploit the railroads, Schlieffen standardized mobilization schedules and organizational procedures, leading ultimately to standardization of war itself. Political objectives became secondary to the military objectives of the war plans. This apathy about the political problems posed by the tangled web of alliances at the turn of the century ultimately resulted in a military plan so inflexible that it overrode political considerations and became, itself, one of the causes leading up to the war.

The Schlieffen Plan's most serious fault was at the strategic level. First, the plan depended on technologies which could only be controlled at the expense of political and strategic flexibility. The criticality of efficiently using all rail cars and lines meant that each train load depended in some fashion on a previous one. As a result, the complexity of integrating mobilization and deployment timetables made it practically impossible to partially mobilize or to execute only a part of the plan. The interdependencies were too great to untangle when time was short in August 1914. So when the Kaiser approached Moltke the Younger, who replaced Schlieffen, to ask about his options for responding to the developing threat from French and Russian mobilizations, he was given the extreme options of doing nothing or going to war.<sup>29</sup> Once the Schlieffen Plan was set in motion, the timetables drove the conduct of the war until the friction which Schlieffen had ignored ground the offensive in France to a halt.

Second, once the war began, the Schlieffen Plan failed to provide any useful secondary objectives which could be used to achieve the national security goals through negotiation or other means, should the military effort end in a stalemate. After the departure of Bismarck and the abandonment of Moltke the Elder's offensive-defensive strategy, German military strategy grew to depend on a rapid victory against one side in any two-front war. Since German military forces were inadequate for a two-front war, degeneration into a war of attrition destroyed the basis of German war plans and put Germany in the gravest danger. To ensure victory, Schlieffen relied on the strategic advantages offered by the railroads and retreated into the insular world of schedules, telegraph lines, and organizational structures, neglecting the possibility that, should his plan fail, he would have to depend on a diplomatic solution.<sup>30</sup> The only hope for Schlieffen was the military one: quick destruction of the French Army. When that failed, he had no fall-back position.

Clausewitz would have been appalled. He had written, "The only question, therefore, is whether, when war is being planned, the political view should give way to the purely military. Subordinating the political point of view to the military would be absurd, for it is policy that has created the war."



Policy is the guiding intelligence and war only the instrument, not vice versa "<sup>31</sup> Schlieffen and Moltke the Younger are without excuse. They both knew that their responsibilities extended beyond presenting a sterile war plan to the Kaiser. Clausewitz wrote, "Nor indeed is it sensible to summon soldiers and ask them for purely military advice."<sup>32</sup> Nonetheless Moltke the Younger presented the problem to the Kaiser as a strictly operational one, pressing him to mobilize and to yield political judgment and caution to the inflexible timetables of the Schlieffen Plan

Clausewitz also pointed out that, "The first, the supreme, the most far-reaching act of judgment that the statesman and commander have to make is to establish the kind of war on which they are embarking, neither mistaking it for, nor trying to turn it into, something that is alien to its nature "<sup>33</sup> Schlieffen's failed to recognize how his unbridled exploitation of technology's capabilities and his neglect of the political nature of war had transformed its nature Technology greatly expanded its scope and destructiveness, while his failure to establish secondary objectives which would support a diplomatic solution placed the fate of Germany at the mercy of his railroad timetables, raising the stakes to the point where it became a war of national survival

In this light, WWI was fundamentally the result of a complete policy failure The Kaiser abdicated his responsibilities as the political leader by not demanding subordination of the military goals to his political ones He failed at his most fundamental responsibility when he allowed Moltke the Younger to use the war plans, developed for no particular political objective to drive the nation into war

Finally, Clausewitz wrote, "No one starts a war - or rather no one in his senses ought to do so - without first being clear in his mind what he intends to achieve by that war and how he intends to conduct it The former is its political purpose, the latter its operational objective."<sup>34</sup> The Schlieffen Plan had the latter but was developed without the former The closest thing to a strategic purpose was avoidance of a protracted two-front war But even that negative goal was an abstraction which begged the question of the underlying political purpose for Germany's entry

The monstrous absurdity of WWI from Germany's perspective lay in its utter lack of necessity or compelling purpose. The French, at least, had strong reasons: revenge and recovery of Alsace-Lorraine. But Kaiser Wilhelm allowed Germany to drift into a war with monumental thoughtlessness about what he hoped to achieve - or what it might cost. Millions of people paid with their lives.

#### APPLICATION

Railroads and telegraphs were to Schlieffen what stealth and information technology on the battlefield are to some military planners today. The spectacular success of some newly employed technologies during Desert Storm has tempted some strategists to announce that technology has "revolutionized" the modern battlefield. It is the same claim that has been made many times before. But technology is no panacea. If cleverly applied, it may bestow a strategic or tactical advantage<sup>35</sup>. But, advantages derived from technology are temporal, relative, and dependent on the reactions of our actual or potential opponents. Each innovation prompts a countermeasure by a potential adversary<sup>36</sup>, affecting the dynamic of the battlefield and the nature of the war in which it is used. Sometimes, as in Desert Storm, the advantage is so great that it can be exploited fully within the temporal limit. However, that very success invariably transforms the next war. Defeat is a better teacher than victory, so we must be careful of the lessons we take from our win.

Today's modern culminating point may not be a geographic position on a map, but rather a limit to the reach of the technologies we use. When we rely, not on human blood and effort, but on computer systems, precision weapon systems, or other technologies to defeat an adversary, the limitations of what they can achieve, where they can reach, when they are effective, and how many we can afford, become critical and define the modern technological equivalent to Clausewitz's "culminating point"<sup>37</sup>. Once that point is reached, the attacker can advance no further toward his objective and has lost the initiative. In modern warfare, with its many forms and its often-blurred lines with the political realm, the culminating point may not be so much a geographic location determined by human limitations as an inability to advance further against certain elements of enemy

power against which our chosen weapons are impotent or of no further value. Military planners must understand that power is limited as much by how we employ it as by its technical possibilities.

The potential culminating point of our power in any conflict scenario delimits our capabilities, and capabilities drive intentions. Political ambitions are fed by expanding capabilities and the perception of strength, while perceptions of weakness tend to blunt or restrict national goals. Hence, the implications of technology on national capabilities cannot be divorced from political goals. Both the strengths and vulnerabilities of technologies must be considered in assessing the degree of added capability they give to national power. Therefore, a military leader is derelict in his duties if he does not carefully evaluate the impact of new technologies or if he oversells them as an elixir for increasing national capabilities or reducing the undesirable side-effects of war such as brutality or violence. Unfortunately, after Desert Storm, some leaders exaggerated the capabilities and advantages of some new technologies in order to get funding, broaden roles and missions, or other political purposes, without critically evaluating their limitations.

As technological improvements proliferate faster than they can be integrated into warfighting systems, it is especially crucial to appreciate that new vulnerabilities come with them. Shrinking budgets, Goldwater-Nichols, the emerging role of the CINCs, and other developments are driving DoD to increased centralization of weapons, C<sup>4</sup>I<sup>2</sup>, navigation, supply, and other systems. This trend is accelerating despite numerous examples of vulnerability to sabotage, espionage, and neutralization. Our increasing reliance on new technologies for warfighting should be a major source of concern for military leaders. We have already developed critical dependencies which could produce catastrophic results if exploited by our potential enemies, many of whom are actively seeking to do just that.

Regardless of the immediate danger, we must not be lulled into complacency by a sense of technological superiority. Those technologies which reduce the friction of war should never be given voice to deny the relevance of the danger they were designed to alleviate. Otherwise, like Germany we may someday be railroaded into a tragic war by an excessive reliance on technology.

1. Carl von Clausewitz. On War. Ed and Trans Michael Howard and Peter Paret (Princeton Princeton UP, 1976) 119

2. In 1914 Moltke the Younger, who replaced Schlieffen, had made some minor changes to the plan (e.g. strengthening the southern part of the line). Some have said that, had he executed the plan as conceived by Schlieffen, Germany might have won. That can never be known and is highly problematic. Moltke the Younger's modifications to the original plan were not major, and, more importantly, they did not correct some of the more egregious deficiencies of Schlieffen's plan which are discussed in this paper and elsewhere. Thus, the German offensive was substantially based on the Schlieffen Plan of 1905, and, though Moltke the Younger executed it, the plan was essentially Schlieffen's. Accordingly, Schlieffen should be awarded responsibility for its major flaws.

Larry H. Addington, The Patterns of War Since the Eighteenth Century (Bloomington: Indiana UP, 1994) 106-110

3. Addington 105-106

4. In Schlieffen's case the technologies involved were relatively simple by today's standards and centered around transportation and communication. Yet, they represent a legitimate basis for comparison with today's more modern technology. "Technology," as used in this paper, comprises the full systems including both the physical objects denoted by the term, and the control systems which render it useful in war. As systems, railroads and telegraph both were sufficiently complex to justify comparison with today's systems, and the lessons to be drawn from those older technologies are still applicable.

5. Clausewitz 606-608

6. Gunther E. Rothenberg, "Moltke, Schlieffen, and the Doctrine of Strategic Envelopment" Makers of Modern Strategy from Machiavelli to the Nuclear Age. Ed. Peter Paret. (Princeton: Princeton UP 1986) 306

7. Schlieffen's term ran from 1891-1906. Rothenberg 297

8. Rothenberg 315

9. Rothenberg 306-307

10. Clausewitz 92 (cf. 577, 596)

11. Moltke wrote that, "No plan of operations can look with any certainty beyond the first meeting with the major forces of the enemy."

Hajo Holborn, "The Prusso-German School: Moltke and the Rise of the General Staff" Makers of Modern Strategy from Machiavelli to the Nuclear Age. Ed. Peter Paret. (Princeton: Princeton UP 1986) 289

12. After Koninggratz, Moltke spoke of the idea of moving separate armies so as to join at the decisive moment on the enemy's flank. "No foresight can guarantee such a final result of operations with separate armies. This depends, not merely on calculable factors: space and time, but also often on the outcome of previous minor battles, on the weather, on false news; in brief, on all that is called chance and luck in human life." Holborn 288

13. Shortly after the dramatic victory in the Franco-Prussian war, he wrote, "Germany cannot hope to rid itself of one enemy by a quick victory in the west in order to turn against the other " Rothenberg 306

14. Rothenberg 307

15. Clausewitz 92

16. Rothenberg 312

17. Rothenberg 314

18. Rothenberg 314

19. Clausewitz 75

20. In any complex plan or system there is always a "critical path" which represents the bottleneck of the process and contains the greatest vulnerabilities of any plan. Removal of one bottleneck often creates a new critical path, increasing the efficiency of the system, but opening up a new set of threats. If the greatest factor in the speed of an army is the limit on how fast its soldiers can march, introducing trucks may dramatically increase the army's speed. But in the process, you will also have introduced numerous vulnerabilities relating to maintenance, logistics, linkage to roads and weather, dependence of timetables on things which didn't affect schedules before, and a host of other complications. This in no way implies that technological innovations are necessarily bad. But the more dramatic the improvement, the greater the potential imbalance in the event of failure, the more dependent on the new technology, the more important it is to build redundancy; the greater the potential improvement, the more cautious should one be.

21. These "less effective" systems may not produce as impressive results, but they often lack the vulnerabilities of new technologies. Even in modern wars, we have had to resort to the most basic of "technologies" when the more modern ones broke down. Thus, when satellites, fiber optics, or radios break down, we have had to resort to messengers. When railroads, or trucks, or C-17s break down, we will have to resort to walking and manual transport. There will always be a need for couriers and forced marches and human strength. This tenet does not come from atavistic opposition to progress, but from the fact that the technologies which are introduced to reduce one of Clausewitz's elements of difficulty become targets themselves.

22. Clausewitz 566-567

23. "War is not merely an act of policy, but a true political instrument, a continuation of political intercourse, carried on with other means " Clausewitz 87

24. Clausewitz 605-608

25. Clausewitz 608

26. Rothenberg 311

27. Rothenberg 311-312, 319

28. Rothenberg 311-312

29. Rothenberg 311-12, 319

30. Rothenberg 305-311

31. Clausewitz 607

32. Clausewitz 607

33. Clausewitz 88

34. Clausewitz 579

35. Elevation of any single tactic or innovation to preeminence may occasionally produce a startling victory but it is usually made possible for one of two reasons. First, the defeated side lacked the knowledge, technology, or tactical/strategic development to employ an effective countermeasure (e.g., breech loaders of British vs Chinese muskets, needle gun vs muskets, satellites/integrated communication in Desert Storm, etc.) Second, and more often, the defeated side had itself ignored one or more developments or had failed to properly employ it or assess its importance. This usually involves underestimating the effectiveness of a particular new weapon or tactic which is available to both sides, and for which there is adequate time to develop and test new tactics or employment strategies.

Systems may eventually evolve to the point where their reliability, simplicity, universality or redundancies render them no longer decisive in the scheme of battle, or at least remove them from the focus of criticality in a general sense. A road system may become sufficiently dense that there are no obvious choke points. Radios may proliferate to the point that the failure of any one will not cost the campaign. Yet all instruments of war are subject to the efforts of both chance and the enemy to neutralize, disrupt, slow down, or otherwise degrade their effectiveness in the conduct of war. Radios may be jammed. Roads can be washed or bombed out. Aircraft can be grounded by weather, etc.

36. Clausewitz 75

37. Clausewitz 566-567